

What is claimed is:

1 A method for making an electronic circuit comprising:
providing a first circuit element, said first circuit element made by steps
including:
5 providing a precursor element including a first insulating layer and a
first conductor attached to said first insulating layer, said first
insulating layer having a first surface, at least a portion of said
first surface defining a first surface plane and said precursor
element having a surface, said precursor element surface
10 including said first surface of said insulating layer;
placing a conducting member onto said precursor circuit element into
electrical communication with said first conductor, said
conducting member including a surface and protruding to an
apex at a first level, said first level at least beyond said first
15 surface plane;
said precursor element surface and said conducting member surface
defining a major surface of a predetermined shape;
placing a second insulating layer onto substantially all of said major
surface, said second insulating layer including oppositely
20 disposed portions extending laterally from said conducting
member along said first surface of said first insulating layer,
said second insulating layer at said oppositely disposed
portions extending to a second level, said first level beyond
said second level;
25 removing at least a portion of said second insulating layer proximate
said apex of said conducting member;
providing a second circuit element with a second conductor;
aligning said first circuit element with said second circuit element; and
applying pressure to said first and second circuit elements, to join said
30 circuit elements, such that said conducting member provides

electrical conduction between said first conductor and said second conductor.

2. The method of claim 1, wherein said precursor circuit element and said second
5 circuit element each include at least one dielectric film.

3. The method of claim 2, wherein said first insulating layer includes said at least one dielectric film.

10 4. The method of claim 1, wherein said conducting member includes a metal bump.

15 5. The method of claim 4, wherein said step of providing said precursor circuit element additionally comprises forming a via in said precursor element in said first insulating layer proximate said first conductor.

20 6. The method of claim 1, wherein the second insulating layer is placed onto said major surface in a substantially uniform thickness and in conformance with said predetermined shape of said major surface.

25 7. The method of claim 6, wherein said oppositely disposed portions of said second insulating layer include surfaces, at least a portion of each of said second insulating layer surfaces defining a second surface plane, and said removal additionally includes removing at least a portion of said second insulating layer beyond said second surface plane.

8. The method of claim 1, wherein said second insulating layer includes at least one adhesive.

30 9. The method of claim 8, wherein said at least one adhesive is a heat-flowable adhesive.

10. The method of claim 1, further comprising, applying heat to said first and second circuit elements.

5 11. The method of claim 10, wherein said step of applying heat includes heating said first and second circuit elements to slightly less than the melting temperature of said conducting member.

10 12. The method of claim 1, wherein said first conductor and said second conductor include copper.

13. The method of claim 1, wherein the step of placing the conducting member onto said precursor element includes deposition of a metal.

15 14. The method of claim 7, wherein said removal includes contacting said second insulating layer with an abrasive material.

16. The method of claim 14, wherein said abrasive material is a microabrasive.

20 16. The method of claim 7, wherein said removal includes placing an article into contact with said second insulating layer proximate said apex, applying pressure to said pressure element, and releasing said pressure.

25 17. The method of claim 16, wherein said step of releasing said pressure includes removing said article from contact with said pressure element.

30 18. The method of claim 16, wherein said article has substantial affinity for the material of the second insulating layer, whereby releasing said pressure includes separating said article from said precursor circuit element, wherein at least portions of the second insulating layer proximate said apex are removed and remain on said article.

19. The method of claim 16, additionally comprising etching said second insulating layer proximate said apex.
20. A method for making an electronic circuit element comprising:
5 providing a precursor element including a first insulating layer and a first conductor attached to said first insulating layer, said first insulating layer having a first surface, at least a portion of said first surface defining a first surface plane and said precursor element having a surface, said precursor element surface including said first surface of
10 said insulating layer;
placing a conducting member onto the precursor circuit element into electrical communication with said first conductor, said conducting member including a surface and protruding to an apex at a first level, said first level at least beyond said first surface plane;
15 said precursor element surface and said conducting member surface defining a major surface of a predetermined shape;
placing a second insulating layer onto substantially all of said major surface, said second insulating layer including oppositely disposed portions extending laterally from said conducting member along said first
20 surface of said first insulating layer, said second insulating layer at said oppositely disposed portions extending to a second level, said first level beyond said second level; and
removing at least a portion of said second insulating layer proximate the apex of said conducting member.
21. The method of claim 20, wherein said precursor circuit element and said second circuit element each include at least one dielectric film.
22. The method of claim 21, wherein said first insulating layer includes said at least
30 one dielectric film.

23. The method of claim 20, wherein said conducting member includes a metal bump.

24. The method of claim 23, wherein said step of providing said precursor circuit
5 element additionally comprises forming a via in said precursor element in said first insulating layer proximate said first conductor.

25. The method of claim 20, wherein the second insulating layer is placed onto
10 said major surface in a substantially uniform thickness and in conformance with said predetermined shape of said major surface.

26. The method of claim 25, wherein said oppositely disposed portions of said
15 second insulating layer include surfaces, at least a portion of each of said second insulating layer surfaces defining a second surface plane, and said removal additionally includes removing at least a portion of said second insulating layer beyond said second surface plane.

27. The method of claim 20, wherein said second insulating layer includes at least
20 one adhesive.

28. The method of claim 27, wherein said at least one adhesive is a heat-flowable
adhesive.

29. The method of claim 20, wherein said first conductor includes copper.
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30. The method of claim 20, wherein the step of placing the conducting member
onto said precursor element includes deposition of a metal.

31. The method of claim 26 wherein said removal includes contacting said second
30 insulating layer with an abrasive material.

32. The method of claim 31, wherein said abrasive material includes a microabrasive.

33. The method of claim 26, wherein said removal includes placing an article into contact with said second insulating layer proximate said apex, applying pressure to said precursor element, and releasing said pressure.

34. The method of claim 33, wherein said step of releasing said pressure includes removing said article from contact with said precursor circuit element.

35. The method of claim 33, wherein said article has substantial affinity for the material of the second insulating layer, whereby upon separation of said article from said precursor circuit element, at least a portion of the second insulating layer proximate said apex is removed.

36. The method of claim 31, additionally comprising etching said second insulating layer proximate said apex.

37. An electronic circuit element made in by the method comprising:
providing a precursor element including a first insulating layer and a first conductor attached to said first insulating layer, said first insulating layer having a first surface, at least a portion of said first surface defining a first surface plane and said precursor element having a surface, said precursor element surface including said first surface of said insulating layer;
placing a conducting member onto the precursor circuit element into electrical communication with said first conductor, said conducting member including a surface and protruding to an apex at a first level, said first level at least beyond said first surface plane;
said precursor element surface and said conducting member surface defining a major surface of a predetermined shape;

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placing a second insulating layer onto substantially all of said major surface, said second insulating layer including oppositely disposed portions extending laterally from said conducting member along said first surface of said insulating layer, said second insulating layer at said oppositely disposed portions extending to a second level, said first level beyond said second level; and removing at least a portion of said second insulating layer proximate the apex of said conducting member.

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An electronic circuit element comprising:

a first insulating layer having at least one surface, at least a portion of said surface defining a first surface plane;

at least one conductor along at least a portion of said at least one surface, a conducting member in communication with said at least one conductor, said conducting member protruding to an apex at a first level, said first level beyond said first surface plane, said conducting member including a surface, said surface of said first insulating layer, said at least one surface of said conductor, and said surface of said conducting member, defining a major surface of a predetermined shape;

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a second insulating layer along at least a portion of said major surface whereby at least a portion of said conducting member remains exposed, said second insulating layer including portions extending laterally from said conducting member along said first insulating layer, said laterally extending portions extending from said first surface plane to a second level, said second level less than said first level.

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39. The circuit element of claim 38, wherein said exposed portion of said conducting member is proximate said apex.

30 40. The circuit element of claim 39, wherein said exposed portion of said conducting member, includes said surface of said conducting member.

41. The circuit element of claim 38, wherein said at least a portion of said second insulating layer conforms to said predetermined shape of said major surface.

5 42. The circuit element of claim 41, wherein said laterally extending portions of said second insulating layer extend from said first surface plane to a second plane at said second level.

10 43. The circuit element of claim 38, wherein said second insulating layer includes an adhesive.